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The Defiance Low Water Alarm.

There is nothing which should more readily engage the attention of the true philanthropist who studies how to lessen the fearful destruction of life and property, and alleviate the pains and sufferings of humanity, than a really perfect safeguard to prevent the explosion of steam boilers. The capitalist can find no better investment for his surplus cash than in developing and introducing such an invention.

A perusal of our daily journals, exhibiting the fearful increase of boiler explosions of late years, causing immense destruction of property and sad loss of life, has impressed on the minds of all practical engineers the great necessity of a perfectly reliable low water alarm. Three-fourths of all boiler explosions are caused, directly or indirectly, by running low water in boilers. Explosions do not always occur immediately after allowing low water in the boiler, but oftentimes the boiler is burned and strained at that time so as to cause an explosion at some future day when there may be plenty of water in the boiler, or oblige immediate repairs, at a loss of time and large expense All engineers admit the great risk of running low water.

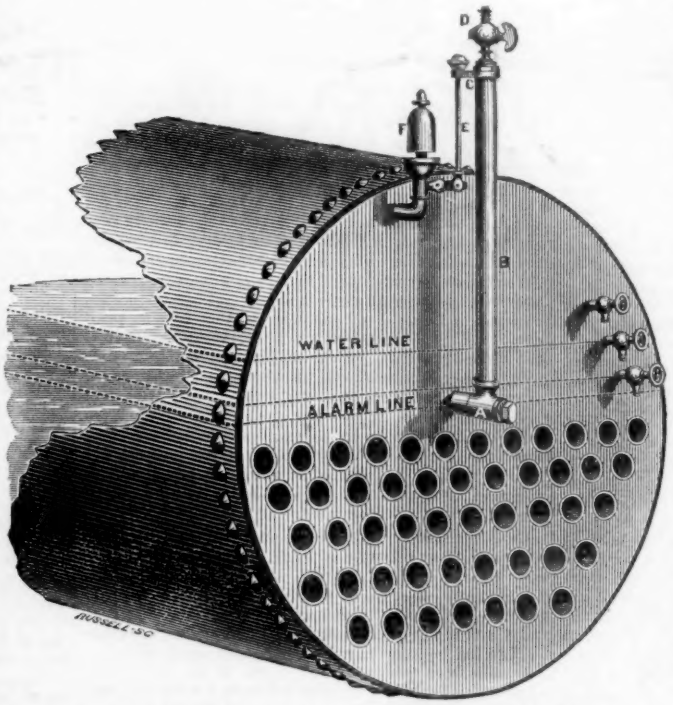
The attention of boiler owners is called to this reporter, as one not only the *most simple in its construction*, perfectly reliable in its operation more easily attached and adjusted, possessing all the merits, with the addition of some important advantages not combined in any other instrument yet offered to the public. The inventor asserts that it is pronounced by all engineers who have examined and tested its operation, as the most perfect low water indicator ever invented. It can be applied to any boiler in less than one hour's time, and after being once acranged can be entirely taken apart, and replaced in less than five minutes—which operation on other instruments occupies from six to ten hours. It is said to report in ten seconds after the water is low in the boiler. Every instrument is sent complete. With others you are obliged to buy piping, joints, connections, etc., at an additional expense. The indicator can be tested at any moment when steam is on, to ascertain if in working order, by merely turning the blow-off cock; if it gives water it is all right. No danger whatever of becoming foul or stopped up with sediment, as the cock will clear it at any time.

Directions.—A, connection for the boiler; B, brass tube; C, arm which rises the rod E; D, blow-off cock; E, rod connecting with the whistle valve; F, whistle. Attach the pipe A at any point you wish to represent low water in your boiler. Many set it on a line with the lower gauge—some just below, others just above that point—attach the whistle F on end or top of boiler; then, when steam is up, adjust the rod E to the proper length by means of the ball on the upper end.

Operation.—When the water in the boiler is above the connection A, the brass tube B is filled with water, and consequently contracted.

Should the water in the boiler fall below the connection A, it also falls in the tube, leaving a vacuum which is instantly filled with steam, expanding the tube causing the rod E to rise, and operate directly on the whistle valve, giving the alarm.

The whistle can be arranged on either right or left side of the tube, as most convenient, by turning the



THE DEFIANCE LOW WATER ALARM.

arm to suit. We learn that many flattering testimonials have been received in its favor.

Manufactured by the American Steam Gauge Company, Boston, Mass. T. W. Cowelin & J. B. Prince 5 Beekman street, Room 5, N. Y., are sole agents.

—A new process for the production of sulphuric acid has been patented in France by MM. Tardani and De Susini. Its great recommendation is that it dispenses with the large leaden chambers. The sulphur or pyrites is burned in compressed air, and the sulphurous acid is first washed to free it from arsenic, etc., and is then brought into contact with the nitric vapors in a small leaden chamber of peculiar construction,

Note on the Occurrence of Sulphocyanide of Ammonium in Gas Mains.

At an ordinary meeting of the Manchester (Eng.) Literary and Philosophical Society, recently, Mr. Hart stated: "That a few months ago while some gas mains in the street were being replaced, I was induced to examine the scale which forms in the interior, being under the impression that probably I should find sulphide of iron the result of long continued action of sulphide of hydrogen on the iron. On placing a portion of this scale in pure hydrochloric acid I perceived an intense reddening, much more than would be accounted for by the simple solution of peroxide of iron, and being aware of the fact of sulphocyanogen being one of the products of the distillation of coal, I at once suspected its presence. A portion of these scales was boiled in water. The clear filtrate from this gave off much ammonia on the addition of alkali, and on the addition of a dilute solution of perchloride of iron it gave at once the intense colouration so characteristic of the sulphocyanides. The insoluble portion remaining on the filter was then boiled in dilute caustic soda; the filtrate from this made acid, and a solution of ferric oxide again added, this time with the production of a blue precipitate indicative of a ferrocyanide. This must have existed as ferrocyanide of iron, which on boiling with the alkali became oxide of iron and ferrocyanide of sodium. There appears to me something curious in the fact of these bodies being carried such a distance (in this case fully a mile from the gas works) by the gaseous current. I should think the ferrocyanogen is the result of a reaction between the sulphocyanogen and the metallic or oxide of iron. The amount of these bodies must, I think, be far too small to have any bad effect on the health of gas consumers."

Cutting Glass by Hot Air.—According to *Les Mondes*, the use of hot air, or gas, for cutting glass, is an invention, already utilized by the Crystal Company of Balcarat. The hot gas issues from a pointed or flattened tube, and is driven directly upon the goblet or other object to be cut, which is placed in close proximity to the tube, and made to revolve upon its axis. A narrow circle of heated glass is thus formed upon the object in question, which being damped immediately afterwards, causes the glass to divide with extreme neatness at the part thus heated.—*Builder.*

—Late advices from Arizona state that the recent surveys for a railroad prove the existence of an excellent route through the San Francisco mountains.

On Some of the Constituents of Coal Gas

A Lecture by Dr. ODLING, F.R.S., F.C.S., etc., before the British Association of Gas Managers.

[From the Journal of Gas Lighting.]

Ever since the French Exhibition of last year there has been much public talk and discussion about the decline of English scientific manufactures, especially in relation to those of the Continent. It has been asserted very boldly that we in this country—where gas lighting took its origin, where the first locomotive ran, and where some of the earliest and greatest successes of the electric telegraph have been achieved—are not making such a degree of progress in scientific manufactures as continental nations are. Now, whether this be the fact or not—and for my own part I am by no means disposed to admit it as a fact—the circumstance of such an allegation being made is, I conceive, a warning to us that we must for the future devote our best energies and wisest consideration to the development of our different scientific industries. Now-a-days the universal panacea for every shortcoming appears to consist in the establishment of what are called technical schools. It is difficult for outsiders to form an exact notion of what is to be the character and purpose of these technical schools, but the prevalent opinion, as I understand it, is something of this kind. Hitherto our mode of teaching young men the business of their future lives has been altogether wrong, and we must at once resort to an entirely different system. Instead of letting them learn their business at factories where work is done for a profit—where it is done in the only way in which it can be done on a large scale, and for useful purposes—they are to learn their business at special schools where all work is to be done solely or primarily with a view to education. Henceforward, instead of gas managers learning the business of gas manufacture at actual gas works, they are to study at model gas-works; metallurgists at model smelting-works; and machinists at model workshops. Now, in common with many of my scientific friends, and more especially Dr. Williamson, who has devoted much valuable thought to the subject, I venture to dissent very strongly from these views. I hold, and I think you will agree with me, that the only place in the world where you can learn to make gas properly is in an actual gas factory, and the only place where you can learn to make and work iron properly is at some actual iron-works. But with regard to science the case is very different; and instead of founding technical schools to teach manufacturing art, I believe it would be of much greater advantage to make the principles of science a far more prominent subject of study at our ordinary schools, so that when young men enter upon their work as manufacturers, they may be able to apply to their respective businesses the exact scientific principles which they will have acquired by the study of abstract science elsewhere. Let science, then, be taught in schools, and the application of science in works conducted on ordinary commercial principles.

These remarks are preliminary to what I have to say to you this evening. I do not come here pretending to teach you how to make or purify gas, for you know that much better than I do; but, inasmuch as gas making is your business, and chemistry is mine, I want to tell you a little about the mere chemistry of your manufacture, and possibly throw out a hint or two that you may be able practically to apply. I wish to point out to you the purely chemical qualities of some of the bodies with which you are dealing, leaving you to make the application of the knowledge, as you are so well able to do. And, even in this limited matter, I am placed in considerable difficulty, for I find that my friend, Dr. Letheby, has gone pretty nearly over the whole of the ground in his previous lectures to you. I have read four of those lectures, and certainly with a great deal of profit, but I cannot say altogether with pleasure, for it is not a pleasant thing to find that, if not all, at least the finest plums have been plucked from the tree. I can only attempt, therefore, to go a little more into chemical detail than Dr. Letheby has done with regard to some of the principle constituents of coal gas, and I purpose confining my attention almost exclusively to those constituents which do not contribute very largely to its illuminating power.

The first of these to which I will direct your attention is hydrogen. Hydrogen is an important constituent of ordinary coal gas, and its proportions vary very considerably in gases of different manufacture. It ranges from 12 to 50 per cent., and more frequently approximates to the higher than the lower quantity. In ordinary London gas the proportion is usually about 40 per cent. Hydrogen gas is characterized by its burning with an almost invisible flame. I have here a jet of the burning gas, but, unless I introduce into the flame a piece of platinum wire, I doubt very much whether those gentlemen who are sitting at a distance can distinguish it; and even with the piece of platinum inserted, the flame is scarcely visible.

In addition to the non-luminosity of its flame, hydrogen is very interesting, for this reason, that it is the only constituent of coal gas which, whether burned at a high or a low temperature, with excess or deficit of air, yields the same product of combustion. I want to give you an illustration of the mode of burning hydrogen at a low temperature, and that I can readily do by bringing into contact with the pure gas as it issues from the jet a piece of platinum sponge mixed with a considerable proportion of clay. On bringing this into contact with the hydrogen, you see that the ball of platinum clay soon becomes feebly red hot. Under these circumstances a small portion only of the issuing hydrogen is being burned, but that small portion so burned is being as completely converted into water as it would be in the oxyhydrogen blowpipe. At present the platinum ball, though very hot—just below a dull red heat—is not sufficiently hot to inflame the hydrogen. In order to effect the inflammation we must bring the light of a flame into contact with the gas, when it at once takes fire, as you perceive. This is the only point upon which I have to offer any remark on the subject of hydrogen—viz., that it may be burned at a high or low temperature, with flame or without, but the product of combustion is always the same—viz., water.

The next constituent of coal gas to which I shall refer is marsh gas, the most abundant, indeed, of all the constituents. It forms generally from 30 to 60 per cent. by volume, and burns with a pale luminous flame. We have here some marsh gas, though not quite pure, and you observe that it burns with a yellowish flame, having but a slight luminosity. I now want to give you an illustration of the mode of burning this gas at a low temperature. In this case, instead of employing platinum sponge, I shall employ a piece of platinum foil. There is, you perceive, a very considerable degree of heat produced during the operation, but not sufficient to inflame the marsh gas, although the platinum foil becomes distinctly red hot. Now, when marsh gas is thoroughly burned, it yields products which consist almost entirely of carbonic acid and water; but when it burns in this way it gives rise to ill-defined products which have an acid reaction, a disagreeable smell, and a power of reducing certain metallic salts. It is of very great importance in burning coal gas that you should get as thorough a combustion as possible, because all these half-burned products have an offensive smell, and it is to their presence that the smell of artificially-illuminated rooms is due.

I will now repeat this experiment with the platinum foil, but instead of taking marsh gas I will employ hydrogen, and you will see that directly I bring the foil into contact with it the gas inflames, the hydrogen being much more easily set fire to than the marsh gas. It is a striking property of hydrogen, as compared with marsh gas, that the degree of temperature which is not sufficient to inflame the latter inflames the former very readily. but though this is true of hydrogen in a pure state, it is not true of it when mixed with the other constituents of coal gas. It is sometimes suggested that because hydrogen gas is capable of being inflamed at an exceedingly low temperature, therefore its presence renders coal gas very inflammable; but such is not the case, for though the coal gas we have here contains 40 per cent. of hydrogen we may make this piece of platinum foil suspended above it exceeding hot, and yet it will not set fire to the gas; whereas when we were employing pure hydrogen, even though the platinum became but just visibly red, it was sufficient to inflame the gas, but diluted as the hydrogen now is to a large extent with marsh gas, the far more strongly heated platinum fails to inflame it.

And this leads me to make an observation or two upon the general nature of flame. I, who stand a little above the imperfectly burning coal gas, have the disadvantage of the smell which arises during the imperfect combustion. Some of you will remember that a little time ago, when large massive burners were employed for heating purposes, they also gave rise to a very offensive smell. Now, there is an impression abroad that although when gas is burned with an insufficient supply of air you do not burn it thoroughly, yet that if you burn it with an excess of air you cannot fail to effect its thorough combustion. But with all those iron burners the gas was burned with an excess of air, and the proof was that you only got a blue non-luminous flame: nevertheless you did not produce anything like a complete combustion of the gas into carbonic acid and water, as evidenced by the offensive smell of the products actually formed. The same thing frequently happens with the Leslie burner when used improperly. When a rich gas is employed, and the chimney is properly adapted, the combustion of the gas is as perfect as possible; but this is not the case in burning from a foot to a foot and a half an hour, when you only get a blue flame just tipped with yellow. Although the gas is then being burned with a large excess of air, you are, nevertheless, not so thoroughly burning the gas as when there is a less proportion of air. We shall readily see how this must be so. In every flame, you may take it, there is an interior portion or core, which is the gas itself; surrounding that is a mixture of air and gas in about the right proportion to give a luminous flame, and around that there is an external film of gas, with air in excess. In the intermediate portion of the flame the combustion is most perfect, though far from complete, and the temperature highest. The core of coal gas surrounded by this intermediate extremely hot layer is decomposed by the heat to which it is exposed just as it would be decomposed in a white hot retort. The decomposed gas is then burned to a more or less complete extent in the intermediate luminous cone—never to a complete extent, since it is always burned with a deficient supply of air, being separated from the surrounding air by the external non-luminous film in which the air is in excess. But even in this external film the perfect combustion of the residual gas is never absolutely achieved, and for several reasons—first of all, because the residual gas is mixed up with so large a quantity of air which requires to be heated to a much higher temperature than the amount of heat in the flame is capable of imparting to it; and, secondly, because the residual gas and air are also necessarily mixed up with the incombustible products of the gas that is already burnt in the luminous cone. Accordingly, in the exterior film, notwithstanding the large excess of air, the combustion is not complete, because of the cooling effected by the large excess of air, and because of the diluting effect of the products of combustion.

Now, it will be found that the complaints which arise about the closeness of rooms heated by gas arise partly from the amount of steam produced, which makes the atmosphere damp, and interferes with free perspiration, and partly from the formation of imperfectly burned products, since in all lamps and candles the combustion is never perfected. There are always some half-burned products thrown off which give rise to the sense of closeness which is not peculiar to gas, but is noticed chiefly in the case of gas, because gas, being the cheapest of all illuminating agents, we are apt to burn it most extravagantly.

Now, I want to give you some experimental illustrations of the nature of flame. Here I have a flask which is supplied with coal gas from an opening blown in its side. At the bottom of the flask is an open tube communicating with the atmosphere, and you will find in this case that we can burn atmospheric air just as well in coal gas as we can burn coal gas in atmospheric air. You see, in fact, that the combustion takes place wherever the two layers come in contact with each other. Here we are burning the gas in air; in the other case we are burning the air in gas. In each case we have in reality a shell of flame, the difference being that in the one case the air is on the outside, in the other it is on the inside. By blowing gently into the air-tube you observe that I am actually able to burn my own breath in an atmosphere of coal gas, just as I might burn a small jet of coal gas in the atmosphere of my mouth. Now, let me give you another illustration of the nature of the combustion of coal gas. We have here a cylinder of coal gas, and in it I may burn any highly-oxidized salt. I may burn, for instance, nitre. Nitre will take fire and burn in coal gas, just as a sulphur match will burn in air. In this case I am not going to burn nitre, but chlorate of potassium, which is a more convenient salt. I make the chlorate just red hot. You observe it does not burn at all in the air, but directly I introduce it into the coal gas it bursts into flame. Here, again, it is simply a question of where the two reacting bodies come in contact with each other. In ordinary circumstances we have the combustible match surrounded by oxygenous air; here we have the oxygenated salt surrounded by combustible gas.

In the Bunsen burner air and coal gas are mixed together before their combustion, whereby we get an almost solid flame; but even in this burner, the problem of perfect combustion is not absolutely achieved, nor is it in the best contrivances with which I am acquainted. I believe the most perfect combustion practically attainable takes place in those luminous flames where you do not, indeed, get the maximum yield of light, but where the gas is a little over burnt with production of a very white flame, as in some of the different forms of button-burner, in Leslie's burner, etc.

(To be continued.)

PREPARATION OF CARBONIC OXYCHLORIDE.—Th. Wilm and G. Wischin recommend the following as the most convenient method for preparing phosgen gas: Pure carbonic oxide and chlorine are conducted through a properly perforated india rubber stopper into a flask of white glass of about 10 litres capacity, the tubes reaching to the bottom of the flask. The mixed gases then pass through a third shorter tube to the bottom of a second, and from there to a third flask of similar sizes. The gas issuing from the last is free from chlorine, and contains only traces of carbonic oxide, if the two gases, as is advisable, enter the first flask in such proportions that the volume of carbonic oxide is slightly in excess. The operation has, of course, to be performed in sunlight.

A SYSTEM

FOR

KEEPING THE BOOKS AND ACCOUNTS OF GAS-LIGHT COMPANIES.

By W. P. FODELL.

Entered according to Act of Congress in the year 1868, by W. P. Fodell, in the Clerk's Office of the District Court of the United States for the Eastern District of Pennsylvania.

PART SECOND.

RELATING TO THE REGISTRATION OF CONSUMERS.

BOOK No. 1—SUBSCRIPTION BOOK—14 x 16½—FORM.

Upon the first page of this book should be written or printed the terms, and upon the top of each page a clause referring to the terms. (see chap. .)

Date.	New Register.	Old Register.	Name.	Location.	Occupation	Located.

☞ For use of this Book see Mode of Registering Consumers.

BOOK No. 2—SERVICE BOOK—11 x 8½—FORM.

Date.	Register.	Name.	Location.	No. of Burners.	Feet of Pipe Required	Size of Pipe.	Springs.	L's.	T's	Bends.	Size of Stop Cock at Curb.	Size of Stop Cock at Meter.	Initial of Workman.

☞ For use of this Book see Mode of Registering Consumers.

BOOK No. 3—PLACE METER BOOK—8 x 6—FORM.

Date.	Register.	Name.	Location.	State of Meter.	No. of Meter.	Maker's Name.	No. of Lights.	Workmen's Initials.

☞ For use of this Book see Mode of Registering Consumers.

BOOK No 4—TICKET BOOK—16 x 11—FORM.

No. Register	No. Register
Date	Date
Name	Name
Premises	Premises
Nature of order	Nature of order
State of old meter	State of old meter
State of new meter	State of new meter
B. T. J. S.	B. T. J. S.

Upon this book, in the margin, is made out a ticket either to *turn on*, *stop off*, *change*, or *remove meter*, the maker putting his initials in the lower right hand corner, and the man who executes it putting his initials in the other corner.

BOOK No. 5—COMPLAINT BOOK—8 x 6—FORM.

Name.	Location.	Nature of Complaint.	Workmen's Initial.

The Registrar will enter upon this book all complaints the consumers may make, which require attention; and have it accessible to the workmen, that they may make a memorandum from it, and put their initials on the book at the time. Upon the workman's return from attending to it he should check it off, denoting that the complaint has been attended to. To be dated each morning. Delinquent consumers who shall have paid their bill, after the gas has been turned off, should be turned on by an order in this book.

Gas Lighting in Bloomington, Ill.

[From the Bloomington (Ill.) Pantagraph.]

We learn that the Gas Company will, this summer, lay three and a half additional miles of gas pipe along the most important streets in our city, and that the City Council have contracted for, and will erect one hundred and twenty-five additional gas lamp posts. When this work is completed, our city will be as well lighted as either Springfield or Peoria, or any other city in Illinois except Chicago. Our own citizens may well be pleased with the effort being made to render Bloomington pleasant and cheerful after night, by being well lighted. A well lighted city makes a most favorable impression upon strangers, evidencing the enterprise and go-ahead spirit of our people; but is also a great inducement to strangers to purchase property and become residents of our rapidly growing city. The action of the City Council in taking the measures mentioned above, to have our streets well lighted, are certainly worthy of consideration. In addition to this is an item of interest to the citizens, that the price of gas has been reduced one dollar per thousand feet, to individual consumers, as may be seen by their advertisement.

Thus it may be seen that the city of Bloomington will be well provided for in point of illumination.

When we take into consideration that the Bloomington Gas Works are more complete in appointment, and possess more of the recent improvements than any other gas works of the same size in the United States, look where we will, and that they are large enough to light the city even if it should grow to 100,000 in population, we think Gen. Gridley is entitled to infinite credit for furnishing to the city such complete works, when we know he does not at present begin to reap an adequate return for his capital invested in them.

Comparing the price of gas here with that of other cities, it is low, for in averaging the price of gas of 20 cities taken at random from the reports of the Gas-Light Journal, we find the same to be $4.50 per thousand feet.

The Bloomington Gas Light and Coke Company publish in the *Pantagraph* the following advertisement:

"Bloomington Gas Light and Coke Company.—From and after the first of October next, the price of gas will be reduced one dollar per thousand feet to individual consumers. It is the intentfon of the Company that gas-light shall be cheaper (for the same amount of illumination) than any other artificial light.

C. W. DOUTY, Superintendent.

Laying Rail Tracks by Machinery.

The railroad track-layer is an indubitable and decided success. It is now working along regularly at the rate of a mile a day, and it will do better when several defects are remedied. Some of its works have been done at the rate of two miles in twelve hours, but one mile is considered its present working capacity. The contractors and directors of the Vallejo and Sacramento Railroad, although most of them were skeptical, and some quite dissatisfied with the delays in getting it into operation, give it the highest praise, and have made their arrangements in reliance upon it. The machine is a car sixty feet long and ten feet wide. It has a small engine on board for handling the ties and rails. The ties are conveyed by an endless chain over the top of the machine, laid down in their places on the track, and when enough are laid, a rail is put down on each side in a proper position, and spiked down. The track-layer then advances, and keeps on its work until the load of ties and rails is exhausted, when other car loads are brought. The machine is driven ahead by a locomotive, and the work is done so rapidly that sixty men are required to wait on it, but they do more work than twice as many could by the old system, and the work is done quite as well. The chief contractor of the road gives it as his opinion that when the machine is improved by making a few changes in the method of handling rails and ties, the necessity of which changes is now apparent, it will be able to lay down track twelve times as fast as the usual rate by hand, and it will do this work at less expense.—*Exchange.*

Explosion of Gas in an English Theatre.—A serious explosion has occurred recently at the Theatre Royal, Preston, England. The stage footlights are supplied with oxyhydrogen, and this dangerous mixture of gases is kept in bags provided specially for the purpose on one side of the stage. Just previously to the commencement of the performance, a man named Catterall and some others were engaged in preparing for the ignition of the footlights by arranging the gas bags, etc., when one of them suddenly exploded. Catterall was blown some distance, his clothes were torn in several places, and he was considerably "shaken" and cut about the chin and face.

New York Society of Practical Engineering.

[Reported for the AMERICAN GAS-LIGHT JOURNAL.]

This society held its first stated meeting for scientific discussion and investigation on Tuesday, August 4th; the President, James A. Whitney, in the chair, and J. B. Lyman, Secretary. The subject before the meeting was "Modern Improvements in Street Pavements," and the President, after a few remarks regarding the objects and proposed future of the society, proceeded to give a brief statement of what is known of the early attempts to construct wooden pavements.

It is not positively ascertained at what time or in what country it was first proposed to systematically use wood in the structure of pavements. The earliest use in Europe for this purpose was in Russia, the streets and courtyards in St. Petersburgh having been paved with wooden blocks long before such paving was known in England. The first attempts to improve it were made in England some forty years ago, and as in all the present plans the wooden blocks were placed with the grain vertical, or with an end bearing. The blocks were made of hexagonal form and simply set in contact with each other upon the soil or ground previously smoothed. The same plan was to a slight extent adopted in some cases for sidewalks in this country, but for street pavements this method was found insufficient, as it failed to give the requisite support to the blocks, and the integrity of the pavement was soon destroyed.

The first attempt of which we have any accurate knowledge to provide a wood pavement which should rest upon a foundation other than the ground itself was made in New York City in 1835. In this year a part of Broadway, between Chambers and Warren streets, was laid with a pavement formed of hexagonal blocks, which, for the sake of experiment, were placed upon three different kinds of foundation; 1st, of cobble stones, 2nd, of broad flagging stones, four inches thick; and 3d, of macadam. After the blocks were laid, the whole surface was covered with melted pitch, and over this was spread a layer of gravel. This pavement is stated to have been capable of enduring for about six years, while the so-called beach stone pavement then in use was said to last but two years. This was doubtless an exaggerated statement, as a pavement made in this manner could hardly have its blocks kept in proper position under travel for so long a time.

The first English patent for an improved wood pavement was granted in 1838, to a Mr. Stead, who proposed making the blocks of slightly tapering form and pinning or dowelling them together when they were laid to form the road. He also suggested that before being used the blocks be boiled in tar or saturated with some similar material, and that a mixture of melted pitch and sand be poured over the surface and into the interstices of the pavement. This pavement was practically tested in London, but we have no knowledge of how it turned out in point of efficiency. In the same year another English projector secured a patent for a pavement made of blocks of wood fitted into iron frames laid side by side. In 1840 another English patent was granted to a Mr. Parkin, in which, for some reason best known to the inventor, the blocks were placed with their grain at an angle of from 45 to 70 degrees; but which in some other respects resembled more or less some of the wooden pavements now before the public; for instance, among other means of fastening the blocks he proposed the use of keys fitted into grooves provided in their lateral faces; he also grooved the upper surface of the blocks to afford a better hold for the horses, and filled the interstices between the blocks with bituminous substances. Among other foundations suggested by Mr. Parkin, was one composed of sand or ashes mingled with tar, and spread upon the ground. In the same year, 1840, Wm. Grimman received an English patent for a wood pavement, in which the blocks were arranged to break joints obliquely, which it was believed afforded a better hold for the horses. The employment of a board foundation was first shown in drawings and model in New York City about the same time, the pavement being in other respects similar to those just mentioned. The subject appears about this time to have excited considerable attention, another wooden pavement having been exhibited at the rooms of the American Institute in 1841. The peculiarities of this system consisted in shoulders provided upon two of the opposite faces of each block, so that the blocks ranged close together might mutually support each other.

Professor William Robinson then read a paper in which, after discussing the defects of stone pavements, he proceeded to the consideration of wood pavements, their present condition and requirements. The writer held that in that class of wood pavements composed of small blocks and in which a continuous subsill or flooring is required, the difficulty of removing a portion to get access below the pavement, constitutes a serious objection; and also that in many cases the movement of heavily loaded vehicles over it will have the effect of displacing the blocks, especially in those cases where there are small spaces formed underneath by the filtration of water, etc. He also took the ground that the use of iron in modern pavements was objectionable, from the rapid corrosion of the metal, and from the loosening of the bolts, etc., by contraction and expansion. After thus introducing the subject, the writer proceeded to consider the merits of the Nicholson, Stafford, Williams, and McGonegal wood pavements, the only ones thus far so fully developed as to be legitimate subjects of discussion.

The Nicholson pavement, belonging to the class just adverted to as composed of small blocks, and too well known to require extended description here, was said to possess all the inherent defects pointed out as belonging thereto, but to have at least established the superiority of wooden pavements as a class over those of stone. The Stafford pavement, formed of sections composed of blocks keyed together by double dovetailed horizontal keys, the sections grooved on the surface to give a secure foot-hold and subjected to the "Seely Preservative Process" to insure their indestructibility, is as yet untested by actual trial, but is believed to be more durable and to have greater stability than the Nicholson, but is more expensive to construct, the great cost being its principal demerit.

The Williams pavement, also a recent invention, is claimed to possess the excellent features both of the Nicholson and Stafford, the board foundation of the former being dispensed with, while the blocks are large, and consequently stable as in the latter, and furthermore impregnated with a preservative and disinfectant substance, which not only insures their durability, but prevents the absorption of liquids and the consequent exhalation in hot weather of noisome vapors. The McGonegal pavement was also spoken of as somewhat resembling the Nicholson, except that instead of being separated by narrow spaces, the blocks are laid closely side by side, keyed to prevent vertical displacement, and having holes bored in its upper surface to give the requisite foot-hold to the horses' feet. That it is not intended to prepare the wood against decay is a presumption against its permanent efficiency.

At the conclusion of the paper above named, Mr. J. B. Lyman gave a brief but comprehensive sketch of the art of preserving wood as applicable to the subject in hand and kindred purposes. He said that when green wood was coated with tar or similar material impervious to water, although the surface may be measurably preserved, the heart will be liable to rot; for this reason the Nicholson pavement blocks, dropped in hot tar and set green upon the road-bed, can be expected to last only a little longer than if no such preservative material was applied. The acids inherent in the sap will act in conjunction with the albumen of the wood to produce dry rot, and then the blocks will be liable to crush under heavily loaded wagons. There can be no reason to suppose that the Nicholson blocks will last longer than railway sleepers, the average time of service of which is about seven years. But these blocks could by proper means be made far more durable, as has been the case with wood used for other purposes, as for instance in sleepers, made to last for twenty years in England by the use of the Bethell process. An American process, that of Mr. Prindle, of East Bethany, N. Y., is peculiarly applicable to pavement. This method consists in boiling the wood in tar, by which all moisture is expelled and replaced by the tar, and then makes the surface absolutely water-proof by a coating of plastic slate. When applied to fence-posts, the cost of this treatment is five cents each, and the Nicholson blocks could be prepared for about one cent each. The speaker concluded by saying that the city government should authorize a report from scientific men on the means by which wood pavements might be made so enduring that they shall wear out instead of rotting away.

After a general but interesting discussion on topics springing from the subject before the meeting, the society adjourned, to meet at the same place on the evening of Tuesday, August 18th. The subject of "Water Meters and Their Uses" will then be considered, and the attendance of those interested in engineering as applied to matters of a practical nature are invited to attend.

CARBONIZATION OF WOOD.—M. Gillot, in his memoir to the French Academy of Sciences on this subject, says the only condition essential for the production of good charcoal, is that the operation shall proceed slowly. The decomposition of wood commences at about the boiling point of water. During the decomposition, the production of carbonic acid causes a development of heat in the retort greater than that outside of it, when the heat applied approaches 300 deg. Centigrade. Too rapid an increase of internal heat gives rise to the formation of tar and gaseous products, diminishing in a corresponding degree the useful accessory products, as well as the yield of charcoal. The condensed products contain the largest proportion of acetic acid (about 48 per cent.) when the temperature of the oven is 218 deg. Centigrade. In this way a given amount of wood will yield about two-thirds its weight of charcoal, and seven or eight per cent. of acetic acid.

On Some Effects of the Heat of the Oxy-Hydrogen Flame.

[A Lecture delivered by WILLIAM ODLING, M.B., F.R.S., before the Royal Institution, May 22, 1868.]

I.

Chemical changes, whether of combination or decomposition, result in the production of new bodies which, under the conditions of the change, have for the most part a greater stability than the original bodies.

One evidence of this greater stability is afforded by the development of a quantity of heat—the heat of chemical action—from the produced bodies having a smaller potential heat than the original ones.

It results, both from reason and experiment, that in order to undo or reverse any definite chemical action, just so much heat must be directly or indirectly expended as was evolved by the original action.

For the same quantity of heat evolved, the resulting temperature varies with the mass and kind of matter heated, and with the rapid or gradual evolution of the heat.

When the evolution of heat is instantaneous, the resulting temperature may be calculated from the quantity of heat evolved, and the mass and specific heat, etc., of the matter heated.

By a unit of heat is meant the quantity of heat necessary to raise the temperature of one kilogramme of water one degree Centigrade, or more accurately from 0 deg. to 1 deg.

II.

Every 18 grammes of water is a combination of two 1-gramme proportions of hydrogen H, with one 16-gramme proportion of oxygen O; and by the combination of two grammes of hydrogen with sixteen grammes of oxygen, there are developed 68 units of heat.

Of these 68 units of heat, however, little more than 57 units are really due to the chemical action—nearly 11 units of heat being evolved by the contraction of the original mixed gas into two-thirds its volume of steam, and by the further condensation of the resulting steam into 18 cubic centimetres of water.

While the quantity of heat evolved by the combination of a given quantity of oxygen and hydrogen is invariable, the intensity of the heat may vary from a scarcely recognizable rise of temperature up to the highest temperature of the oxy-hydrogen blowpipe flame, capable of fusing platinum and silica.

A most remarkable effect of the intense temperature resulting from the combination of oxygen and hydrogen into water, is the partial decomposition of water into oxygen and hydrogen, discovered by Mr. Grove in 1846.

At this high temperature, hydrochloric acid and carbonic anhydride gases also undergo partial decomposition, into hydrogen and chlorine, and into carbonous oxide and oxygen respectively.

Upon what do these singular decompositions by heat, of bodies formed with great evolution of heat depend; or with what class of chemical phenomena may they be associated?

III.

Under certain familiar conditions, chemical action seemingly takes place to its utmost possible extent in a single direction only, with production of a maximum amount of the substance that is formed with maximum evolution of heat.

For example, taking atomic proportions in grammes, the heat of formation of chloride of zinc, $ZnCl_2$, is 101 units, and the heat of formation of chloride of copper, $CuCl_2$, is 60·5 units. Hence, with chlorine in solution and excess of both copper and zinc, there is finally produced the maximum possible amount of chloride of zinc and no chloride of copper.

Again, an addition of sufficient zinc to solution of chloride of copper, there is complete combination of chloride with zinc and complete separation of chlorine from copper, that is, complete burning of the one metal and complete unburning of the other.

IV.

But under simpler though less familiar conditions, chemical action habitually takes place in more than one direction simultaneously, with production of correlative products in varying proportions.

Thus, with hydrogen and excess of both chlorine and oxygen, although the heat of formation of oxide of hydrogen H_2O is 57 units, and the heat of formation of chloride of hydrogen $_2HCl$, is only 47·5 units, yet, in this case, the hydrogen does not combine with the oxygen to the exclusion of the chlorine, but divides itself between the oxygen and the chlorine in proportions which vary with the conditions of the experiment.

In accordance with this result it is found that, at the same red heat, excess of chlorine will effect the partial decomposition of water with extrusion of oxygen; and conversely, that excess of oxygen will effect the partial decomposition of hydrochloric acid with extrusion of chlorine.

So that, beginning with the two chemical substances, water and chlorine, or beginning with the two chemi-

cal snb tances, hydrochloric and oxygen, or beginning with the three chemical substances, hydrogen, chlorine, and oxygen, there exist, at a full red heat, the four chemical substances, water, hydrochloric acid, chlorine, and oxygen; the proportions of the four substances depending certainly upon the relative quantities present of the elements concerned, and most probably also upon the temperature of the experiment.

Similarly, beginning with the one chemical substance, water (Grove), or beginning with the two chemical substances, oxygen and hydrogen (Bunsen), there always exist, at a sufficiently high temperature, the three chemical substances, water, oxygen and hydrogen.

Although, by exposure to a red heat, the electrolytic mixture of oxygen and hydrogen gases becomes completely combined, or transformed into water, yet, as recently shown by Bunsen, at the high temperatvre of 2024 degrees, only one half, and at the still higher temperature of 2844 degrees, only one third of the mixture undergoes combination, the other one half or two-thirds remaining in the state of mixed gas.

V.

Chemists are acquainted with many reciprocal actions comparable with those of chlorine upon water, and of oxygen upon hydrochloric acid, the most familiar instance being probably the decomposition of ignited oxide of iron by hydrogen with extrusion of iron, and the converse decomposition of oxide of hydrogen by ignited iron with extrusion of hydrogen.

Similarly, sodium will decompose the oxides of carbon, while carbon will decompose oxide of sodium; and just as a sufficient excess of chlorine may be made to effect the almost complete decompos tion of a given quantity of water, so may a sufficient excess of carbon (or carbonous oxide) be made to effect the almost complete decomposition of a given quantity of sodium ox ide or zinc-oxide, as in the ordinary processes for obtaining the two metals; notwithstanding that, for an equal consumption of oxygen, the respective combination heats of sodium and zinc exceed by far the combination heat of carbon or carbonous oxide.

Again, although the combination heat of oxygen and carbonous oxide is 68 units, while that of oxygen and hydrogen is only 57 units, yet, as was shown by Bunsen many years ago, upon exploding a mixture of oxygen with a joint excess of carbonous oxide and hydrogen, the oxygen does not attach itself exclusively to the carbonous oxide, but divides itself between the carbonous oxide and hydrogen in a ratio determined by their relative proportions.

Correspondence.

Interesting Letter from California.

[Correspondence of the American Gas-Light Journal.]

NUMBER TWO.

Wadsworth House, San Francisco, June 27th, 1868.

Messrs. Editors: In my last communication on the State of Nevada, I concluded with an introductory description of the Humboldt County district, which I had prospected: I will now enlarge thereon, and describe a four hundred miles' journey therefrom in a southeasterly direction, and my return by a different route The Humboldt Mountain is situated near the centre of a very large county of this name; the highest point of its profile is called Star Peak, which is, in common with its general upper crust, composed of blue limestone, that has been upheaved by an extensive and powerful volcanic dyke, to the elevation of 11,500 feet above the level of the sea. This dyke, protruding from its eastern side and running for upwards of 20 miles, has uplifted and produced the various modified formations of carbonate of lime, clay slate, granulite, syenite, feldsite, quartzite, porphyry, trap, and lava. Standing on Star Peak as a centre, a fine summer's day unfolds a most extensive and instructive radial view of 160 miles westward to the Sierra Nevada, south to Arizona, east to the Austin Mountain, and north to the pinnacles of Idaho; being an area of 90,000 miles, that is inhabited by four Indian tribes. This view is as conspicuous as many sea views of but 30 miles; and the landscope terminated from the rotundity of the earth more than from the haze of atmosphere. It is peculiar for the rugged, di-jointed contour of its enormous amount of irregularly washed naked rock on the mountains, which trend north and south, like as many very elongated, equi-distant, pyrimidal islands in the ocean; the sand flats being all about the same level and alkaline appearance, whereon the sage and grease bush grow, alone, in the wilderness.

It is indeed a strange land; its climate is as mild and pure as its aborigenes are wild and fierce; however rich its bold perspective, the mineral prospects are as poor, though the mountains expose thousands of square miles of naked bed rock, but few ledges are found to reward the prospectors of this vast cemetery, where, in the gradual uprisings from the ocean's muddy bed, fish, animals, and forests grew and petrified. Now, meandering rivers sink, through the volcanic chasms and debris of past ages. A perfect combination of panoramic illustrations, showing the diversified and progressively provisional intention of the great Creator from the time when "the earth was without form, and void."

To avoid idleness, and endeavoring to benefit by any discovery I might make or realize from the hundreds of locations that had been made by others, and offered to me if I would recommend and sell them, I have prospected and examined during a period of 16 months, a belt of ground 400 miles long (east and west) by 200 miles (north and south) without finding anything that would even pay its way from the surface, or any that I could recommend conscientiously for early and certain profits; and but few for speculative development. In journeying from this Humboldt Mountain south-easterly, the first range (which I have crossed in eleven places) is composed of similar elements to the formes, with greater ratios of porphyry lava and volcanic feldspathic mixtures.

The second, third, fourth and fifth ranges are almost entirely composed of porphoritic and other feldspathic varieties, with rare and small patches of ungenerous clay slate and carbonate of lime, uprisen from the flats, in which no ledges of great value have been discovered.

The sixth range, constituting what has been denominated the Toyabe or Austin Mountain, and the Reese River district, is more primitive is structure, being of the various granites, gneiss, granulite and syenite, with occasional volcanic dykes, and patches of secondaries This appears to be the only *extensive mining field* with sufficiently interesting inducements for capitalists that I have seen between the Sierra Nevada and the Rocky Mountains.

The lodes, though small, have been sufficiently productive for profitable returns in several instances; and had the mines been more aggregated by consolidation of companies, and the expenses of superintending, "bossing," shafting and tunneling consequently lessened, much greater profits would have resulted. The ledges dip with the strata, are close together, in cheap ground, and could be worked on a concentrated large capital by practicals, so as to develop them for reserves to await more extensive returns, when favored by the more economical supplies of labor and materials from the greater facilities afforded by the Atlantic and Pacific Railway.

Travelling S. S. E. about 90 miles, and crossing over the seventh range, which is mostly composed of porphoritic formations, the district of Philadelphia, or the "Silver Bend," is situated and uplifted from the flat, as small foot hills of clay slate, in a lap of the porphyritic mountain, and over a very strong quartz-ore reef, that extends for a considerable distance. In this small district of clay slate, which dips about 50° easterly, the High Bridge ledge has been discovered, which dips with the stratum, and is being worked by several companies in extension. This ledge was developed some 60 feet deep at the time I visited Belmont City, and ave aged in the shaft, open cut, and under drift, 4 feet in width; it was a well defined ledge, and contained sufficient argentiferous mineral to pay for extraction, roasting, and milling, even at this depth, and offered most enticing inducements for deeper explorations, which would soon cut sufficient water for all necessary steam power, that should have been erected immediately under the mine, after it was thus established.—These mines, properly worked, will yield good profits, though the *district* being small, affords slight chance for discovering many ledges of value.

The eighth, ninth, tenth, eleventh, twelfth, and thirteenth ranges are even more igneous than those described, and possess little of the concomitants of superlatively rich mining fields. On the slopes of the eleventh and twelfth, in upraisings of ungenerous lime stratum, are the districts of Hot Creek (Rattlesnake Cañon) and Reveille, where rich irregular pockets of silver ores have but infatuated the inexperienced, and injured the real legitimate mining of quartz ledges by companies possessed with the necessary funds for realization on the large scale.

Having ridden 15 days, and my horse, by carrying 250 lbs. (myself, food, blankets, pick, rifle, six-shooters, cooking tools, etc.) at the rate of 30 miles per day, feeding on the very slight and irregular bunch grass and water to be obtained in such a chance journey over strange ground, and trammeled with picket rope or "hobbles" during the night, for safety, as I was alone, I deemed it better to return to Humboldt, and proceeded thither by a different route, thereby exploring a double length and breadth of country, without, however, seeing much to interest me as a miner, though infinitely interesting to the geologist, realizing the purple creations of the painter, and affording such scenes of grandeur as are seldom surpassed.

In conclusion I must say that, as a whole the *discoveries* of the Nevada State have been painted far too rosily, as too many are painfully aware, and the negative total balance shows. My impression is that much valuable mineral lies in *unseen* ledges below the foothills of the mountains, under the sand debris that cover the *secondary flats* between the mountains, and *near their junction* therewith; but this will lie for the more systematic perseverance of future generations; in the meantime the State of California, containing such vast areas of uplifted clay slates, exposes the largest and richest mining field yet discovered in the world.

J. S. Phillips, Mining Engineer.

Expansion of Iron Retorts.

Hagerstown, Md., July, 25th, 1868.

Messrs. Editors: I would like to hear the opinions of your many readers in reference to the expansion of iron retorts. Not long since, in taking out a 9-foot 6-inch retort, I found it completely divided in the centre, and came out in two pieces. I find it invariably the case; the expansion is much greater in the middle than in the other parts. I don't think the cause is from unequal heats, for the heats appear to be equal all through excepting about a foot from the mouth-piece. I think the remedy might be found by casting ribs along the retort, say commencing about a foot from the mouth, running back within 6 inches of the back. The dimensions might be about 1¼ by 2 inches, four in number, the first one about 6 inches from the bottom, and the others at equal distances. I think it would add materially to their durability and prevent the much dreaded cracking in the middle. I would like to hear the views of those interested, foundry men as well as gas men. Respectfully yours, Geo. Coles.

[Clegg gives reports of retorts cast with ribs.—Ed.]

Advice to "Y. Z."

Messrs. Editors Gas-Light Journal: In answer to the inquiries of your correspondent, "Y. Z." through your issue of June 16th last, I would advise him to use clay retorts at a white heat; to lengthen his intermediate run between hydraulic main and condensing system; to stiffen the efficiency of this last; *and not to overcharge his heats.* Work on five-hour charging, of course. No gas-maker, worthy of the name, ever sees tar in his purifiers.

The *outside* temperature, of mere plebeian atmosphere, has nothing to do with this, the simplest of our difficulties. Respectfully, J. R. S.

Smedberg's "Synopsis of Gaslighting."

Office Gas Light Co., Macon, Ga., July 39, 1868.

Messrs. Editors: Being anxious to get all the light that is current on the art of making gaslight, you will please add the undersigned to the list of subscribers for Smedberg's "Synopsis of Gas Lighting," and oblige.

Yours respectfully, Hugh McLane, Sup't.

The following subscriptions to the above work are asknowledged, making in all 190.

Hugh McLane, Sup't Macon, Ga., Gas-works.
C. F. Chandler, Columbia College, N. Y. City.
Wm. B. Brooks, Ag't Dorchester Gas Co., Mass.

Gas Explosion at the Capitol.

A gas main at the Capitol at Washington, under the centre of the dome, in what is known as the Washington crypt, exploded on Friday afternoon, August 7th, with very great force, blowing out all the heavy frame-work surrounding, and tearing all the doors, frames, and windows to splinters, and scattering the fragments through the basement passages in all directions. The effect of the explosion was such as to create alarm for a time for the safety of the building. Part of the funeral paraphernalia of the late President Lincoln, which been placed for safe keeping in the crypt, was ignited by the flames and partially destroyed. The broken glass from the basement windows was blown through the passages as far as the west entrance to the building, and portions of the woodwork were scattered through a large portion of the eastern and southern wings of the old building. Notwithstanding the great apprehension and dread attendant upon an immediate investigation of the affair, all the employes were promptly on hand to lend their assistance, and measures were at once taken to prevent further damage, as well as to repair that already occasioned. Fortunately no one was in the immediate vicinity at the time of the accident, or the result might have been much more serious. As it was no one was injured.

PATENT CLAIMS.

Pertaining to Gas, Water, etc.

80,568.—Gas-Burner Attachment.—John Scholl Soho, assignor to Samuel S Bateson, Mayfair, Eng.

I claim, 1. The combination, with a platinum or other equivalent gas-light improver or perfecter, of a guard or protector, for the purpose hereinbefore set forth.

2. The peculiar modes of combining a gas-light improver or perfecter with a guard or protector, whereby the former is maintained, through the agency of the latter, in its proper adjusted position, substantially as hereinbefore described, and illustrated by the drawings.

80,642.—Manufacture of Illuminating Gas.—William L. Lowrey, Saratoga Springs, N. Y.

I claim, 1. The process of distilling illuminating gas from coal-tar, hydrocarbon-oils, resins, wax, and the residuum of petroleum, substantially as described.

2 The use of the hydrate of lime, within the chamber or reter, in the manufacture of illuminating gas in the ordinary way or by my process, substantially as herein described.

80,712.—Base burning Stove.—T. Parsons Dickerman, New Haven, Connecticut.

I claim, in combination with the reservoir or cylinder, B, of a base-burning stove, the slide or cut off, D, arranged and applied substantially in the manner herein set forth.

80,714. Water-Meter.—A. B. Edmunds, Melrose, Mass.

I claim a water-meter or motor, made with valve-blades or flaps, hinged to and swinging against and from an axial drum such blades being rotated by pressure of the water entering the meter-case through the eduction-pipe and each valve-blade being thrown out from the drum as its outer edge passes the abutment or wall, substantially as set forth.

80,268.—Apparatus for Carburetting Gas and Air.—Alonzo T. Boon and Albert T. Perry, Galesburg, Ill.

We claim the emery-receptacle, F, when combined and arranged with a float, h, screw-rod, valve, m, pipe, N, and pipe H, substantially in the manner and for the purposes as herein shown and described.

80,488.—Water Meter.—Gustav L. Jaeger, New York.

I claim, 1. The arrangement of mud-cistern b, and strainer a, in the plug of the stop-cock D, substantially as and for the purpose described.

2. The rods i, and cranks k, connecting diametrically-opposite buckets of the wheel B, which runs in the scroll E, substantially as and for the purpose set forth.

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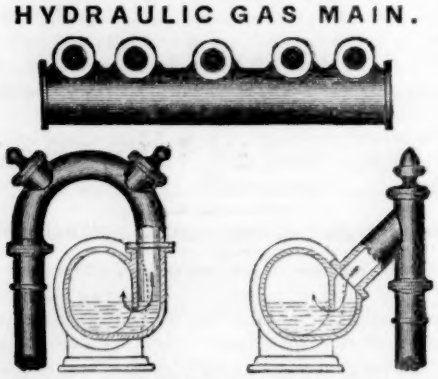

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BY W. P. FODELL.

This work is gotten up by W. P. Fodell, Secretary and Treasurer of the Northern Liberties Gas Company, Philadelphia, and is a compilation of forms for books and directions for their, use, and is intended to present a system that shall be at once plain, orderly and full, from which reports and statements of the conduct of the works of any required nature can be made at any time.

The work will be divided into four parts, each connected with the other, viz :

Part I.—Relating to the Manufacture of Gas—Superintendent's Department.

Part II.—Relating to Registration of Consumers—Registrar's Department.

Part III.—Relating to Collection of Bills—Receiver's Department.

Part IV.—Relating to Stockholders—Treasurer's and Secretary's Departments.

Any one or more of the books of each department might be used in the infancy of a work, without adopting the whole; or incorporated into a work already in operation.

Builders of gas works could put this book in the hands of a person of ordinary intelligence, enabling him to keep the history properly.

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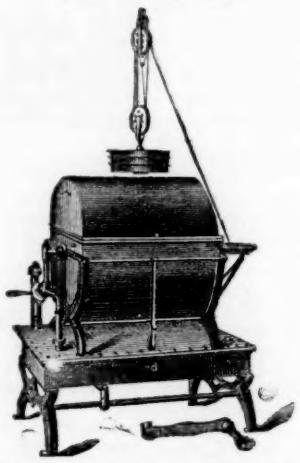

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TESTIMONIALS.

Southboro', March 29, 1867.

Messrs. O. P. Drake & Co., Boston:

Gentlemen: I will say that I had your Gas Machine in use about nine months, manufacturing gas for lighting my store. The light is good, clear, and at all times reliable. Its cost is less than half the cost of street gas. As regards safety, I think it very much safer than kerosene lights. Yours respectfully,

WILLIAM C. BARNES.

Lake Forest, Ill., Aug. 30, 1867.

Chas. Matthews, Esq.,

Ag't for Drake's Solar Gas Machine, Chicago:

Dear Sir: * * * * * * * * * I would say that I have had the machine in constant use for the last six months, and am well pleased with it. The light is clear and steady, and the whole apparatus works to my entire satisfaction. Yours,

WM. S. JOHNSTON, Jr.

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No. 1	$	No. 5 a 150 light	$1,000
" 2 a 15 light	250	" 6 a 300 light	1,800
" 3 a 30 light	350	" 7 a 400 light	3,500
" 4 a 75 light	550	" 8 a 500 light	3,000

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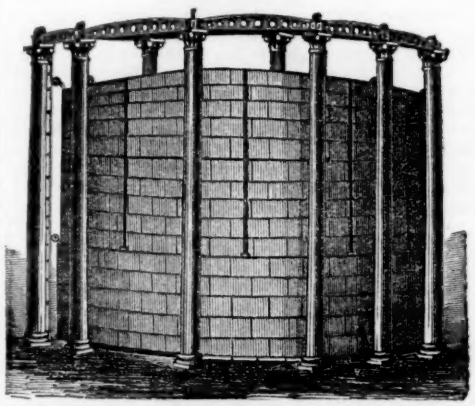

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Mines in Harrison County, West Virginia.

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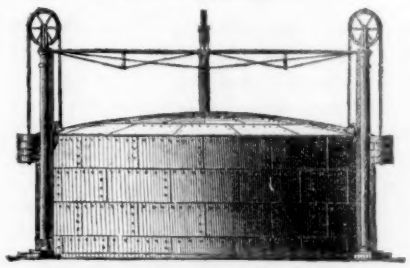

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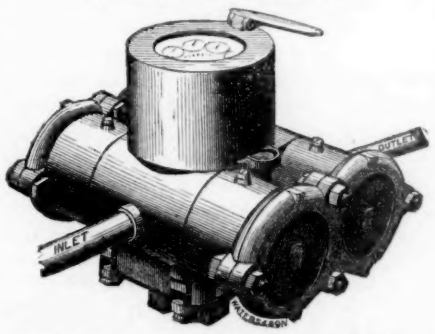

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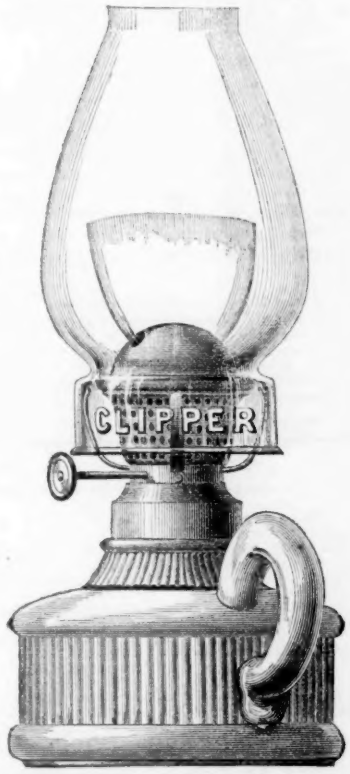

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Answers to Correspondents.

J. W. R., of Ohio.—There is no reliable rule for determining the pressure of gas in main pipes, by the pressure at the station. The best way to ascertain the pressure at any part is by the gauge.

W. B., of Pa.—In generating hydrogen gas from water by the use of zinc and sulphuric acid, you should expel all the air from the receiver before you close it to retain the hydrogen, because the latter mixes with the oxygen of the air and forms an explosive mixture. Hydrogen gas can be generated under considerable pressure.

A. J. B. of Ga.—An explosion cannot take place from carbonized oil in a boiler by the gas mingling with the oxygen of the water, as you have stated, because there is no free oxygen in the boiler. Certain kinds of water produce priming in boilers, but the water is not explosive on that account.

J. W. S., of Mass.—As the water in the boiler of a steam engine is evaporated into steam, the supply can be kept up only by forcing water into the boiler against the pressure of the steam, and this is done by means of the feed-pump. If either the receiving or delivering valve should become so deranged as not to permit the passage of the water, the pump of course would not work.

A. D., of Cal.—Oxalic acid will clean iron as easily as brass. Make up a dilute solution and apply it quite hot with a sponge, then wash off with hot water and dry perfectly.

G. M., of N. O.—The Worthington Water Meters has given great satisfaction wherever they are used. Nine are now in use at the St. Johns, N. B., Water Works. They are to be had at 61 Beekman street, N. Y.

M. S. W., of Va.—The Patent Office employs its own draughtsmen. They are appointed by the Commissioners the same as other officers. The office does not prepare drawings for applicants; these must be furnished.

THE BOARD OF HEALTH AND THE GAS COMPANIES.

We printed in our last number a lengthy report on the nuisance created by the dry-lime purification of illuminating gas. The report forms one of the weekly emanations of Dr. Harris, of the Board of Health, and is well calculated, in the absence of cholera or other threatening epidemics, which according to that sage of the Board are always before our doors, but in reality never appearing, to attract public attention, and to impress the unwary with a vague belief of the importance and usefulness of that gaseous fraternity known as the Metropolitan Board of Health. The redoubtable Doctor stalked forth on a Sunday morning for the benefit of mankind, in quest of some hitherto unknown cause of zymotic disease, and guided by his keen olfactory sense which did not perceive the decaying filth and garbage of the streets through which he passed, nor the stench of the sewers, the learned Doctor steered directly to the Metropolitan Gas Works, foot of West Forty-second street, and finally alighted on a heap of waste lime, poked his finger into it, stirred it with his umbrella stick, and cried out: "Here I have it, the veritable corpus delicti which has offended me near my residence!"

He reported his investigations to the Board of Health. He embraced that opportunity to inform the world, with his accustomed modesty, that he had inquired and ascertained year by year the progress of practical improvements in the methods and means for purifying illuminating gases, that some of the most learned chemists and hygienists had given their aid, and that these improvements in sanitary chemistry have been so thoroughly, scientifically and practically tested or investigated that gas engineers should renounce the "dry-lime method" of purifying, and adopt in its place some one of the improved and sanitary methods of gas purification, that all the nuisances of the dry-lime method can and will be avoided, the illuminating gas be rendered even more pure than the lime purified gas can be, and the cost of purifying be diminished, and that there are at least three methods by which these great advantages can be secured.

It is to be regretted that the learned Doctor omitted to add to his verbose report a description of those three methods, so that gas companies might have an opportunity of availing themselves of their advantages, and of profiting by his researches and discoveries. He also omitted to state in "which" gas works he made the practical tests of his great improvements. We are inclined to believe that his Sunday visit to the Metropolitan works imparted to him his first practical lesson of gas manufacturing, and that he has admirably succeeded in manifesting his ignorance of the subject.

He certainly has not made his investigations in the recesses of his literary sanctum. How could he have been ignorant that there is a gas literature, that many eminent scientific men have devoted their lives to the investigation of the best methods of gas manufacture; that their discoveries are embodied in hand books, and that Gas Journals continually inform us of the progress which is made in that branch of industry. The learned Doctor could not have helped to stumble accidentally over the last edition of the Treatise on Coal Gas, by Samuel Clegg, Jun., (an authority rather better acknowledged than E. Harris). He would have found in it an elaborate review of the score of methods of purifying illuminating gas, in which methods the three occult methods of the learned Doctor are probably also included, and he might have read there that "common lime, used "in a dry-lime purifier, is the most effectual, the "most economical, and the least hurtful agent by "which the impurities of coal gas can be removed, "and that it may, indeed, be taken as a generally "admitted fact that, when any of the salts of lime "are so placed that the current of impure gas may "first pass through or upon them, and afterwards "traverse the filled compartments of a dry-lime "purifier, that then the greatest known perfection "of coal gas purification is obtained."

This opinion is not based upon theory or imaginary researches like those of Dr. Harris, but upon practical results on a large scale, and upon the experience of many years; and intelligent gas engineers and chemists, therefore, do not labor to remove the dry-lime process, but to improve it, and to remedy its only objection—viz, the stench emitted by the refuse lime if not properly deodorized, which objection, however, is shared by all other purifying processes known.

If the Metropolitan Company, under its present management, and in its eagerness to substitute some other illuminating mixture in the place of coal gas, has overlooked the necessity of deodorizing the refuse lime, it should be admonished that an alteration and improvement in that respect is absolutely needed and that it cannot with impunity continue to annoy the neighborhood, particularly not to such a distance as Thirty-fourth street, where the learned Dr. Harris lives. It might, with advantage, have adopted the methods of the Manhattan Company of deodorizing the refuse lime, methods only indicated in hand books, but worked out with great mechanical skill and chemical knowledge, and with the most satisfactory results by that Company.

The waste lime, before being removed from the boxes, is here completely changed in its composition by a powerful current of air. The unstable combinations of sulphur with calcium and ammonium which had been formed in the coal gas atmosphere, but which break up by the access of air, are oxydized, and transformed into stable and fixed salts. The gases evolved during that process are not allowed to escape, but are forced through a dry-lime purifier, where they are robbed of their sulphur and ammonia and other nauseating compounds, and are again by the action of the atmospheric current converted from sulphurets into hypo-sulphites and other salts which are perfectly stable and evolve no smell whatever. The perfection of that process is such that the refuse lime is completely changed in its combinations and revivified; that it can be used over again for the purification of coal gas, and that a moist acetate of lead paper held over it will not be stained, a test by far more delicate and reliable as proving the absence of sulphuretted hydrogen than the olfactory sense of a sanitary inspector of the Board of Health.

We must therefore condemn in the severest terms the adverse report of a learned Doctor E. H. Janes on the condition of the Manhattan Company because they use lime for purification. We have also seen and examined a large number of gas works, both here and in Europe, and state, with national pride, that the Manhattan works on Eighteenth street, imposing as they are in size, are a model in all their appointments, in neatness and cleanliness, and in the scientific, practical manner in which gas making is there conducted. It is a positive relief, after wading through the nauseating filth and dirt of the streets, to enter upon the precincts of the Company's works, and to breathe again pure air which, if impregnated with any smell, is impregnated with the smell of carbolic acid, a substance so largely produced in gas making, and so eagerly bought up and recommended by the Board of Health as a disinfectant. A beautiful flower garden and rare trees delight the eye, and delicate exotic plants climb up the walls and open windows of the purifying house,

luxuriating in an atmosphere which is reported to be so detrimental.

That learned Dr. Janes also enlightens the world about some "late" improvements adopted in the process of purifying (by oxide of iron) and cites the New York Gas Works as an example of their effectiveness. These "late" improvements, learned Doctor, are about 20 years old, and we may state that the Manhattan Company used oxide of iron for the purification of foul gases some ten years ago. But why did the learned Doctor not inform us how his olfactories were affected at the New York Gas Works when they exposed the foul oxide to revivify in the free air, whether it smelled of roses or violets In the absence of his reliable testimony, we may be allowed to quote W. R. Bowditch (London, 1867), who states: "When the foul oxide is spread out to "revivify, it gives off a quantity of very offensive "compounds which seriously annoy those who re- "side in the neighborhood of a works where foul "oxide is exposed to revivify in the free air." These oxides are occasionally heated up by the addition of foul ammoniacal gas liquor—an old aromatic process, and by the carelessness of patent examiners even patented some time ago by a Dutch engineer, a Mr. Howitz, of Copenhagen.

Unreliable, therefore, as the olfactories of Sanitary Inspectors seem to be in regard to the odors emanating from gas works, the consumer will do well not to attach too much importance to their sporadic attempts of writing themselves into notoriety, and rather trust to the experience of scientifically conducted gas companies. There are other more important considerations affecting the health and comfort of the whole community why coal gas should be purified by lime and not by oxide of iron. Long experience in the large cities of England where the oxide of iron purification has been adopted because the cartage of lime was expensive and troublesome, has conclusively demonstrated that coal gas, when purified by oxide of iron, retains a certain quantity of sulphur compounds which are not detected by test paper, but which, on burning, are converted into sulphurous acid; and that by abandoning the dry-lime process of purification a very serious trouble was transferred from the works into the residences of gas consumers. The annoyance of those sulphur compounds which render combustion so offensive and injurious, has become so serious and prejudicial to health that the amount of sulphur allowed to remain in coal gas was fixed by Act of Parliament, and was limited to 20 grains of sulphur for 100 cubic feet of gas. Although that limit is very liberal, the companies find it exceedingly difficult to conform to the law. They often exceed the legal allowance, and after many ineffectual attempts of removing the difficulty, begin to resume the "dry-lime method," and to renounce the oxide of iron method. We quote from Dr. Letheby's Report of March 10th, 1868, on the illuminating power and chemical quality of the gas supplied to the City of London during the last twelve months, the following passage for the information of the Board of Health: "And if the present practice of the Great Central "Company, of *using lime* for the purification of the "gas be carefully followed out, as Mr. Hawksley "and I have recommended, the quantity of sulphur "in the gas will do doubt be kept—as it now is— "under the amount sanctioned by Parliament." Also from the Inaugural Address of Thomas G. Barlow, President of the British Association of Gas Managers, of June 2nd, 1868: "In the process of "purification but little progress has been made. "Experience, however, seems to confirm Dr. Le- "theby's opinion, that the sulphur compounds in "gas may be considerably reduced by dry-lime "purifiers of large surface through which the gas "passes slowly."

This opinion is quite correct, because the best practical solvents of those complex sulphur compounds in coal gas are the alkaline sulphides which are so largely, and we might almost say providentially formed in a dry-lime purifier.

In view of all these facts, the scientific reputation of the inspectors of the Board of Health who want to force an abandonment of the dry lime method, and the adoption in its stead of the oxide of iron method of purification, is not an enviable one. We hope there is enough intelligence left in the community to oppose an abuse of power which would result in the distribution, along with the gas, of more than one ton of sulphur per week, to be burnt into two tons of sulphurous acid at the residences of the consumer. But let us not be too quick, because the learned Doctor says he knows at least *three* processes by which the illuminating gas itself can be rendered more pure than the lime-purified gas can be, and he has not yet divulged them. Now, learned Doctor, do not place your light under a bushel, try to overcome your aversity to writing public documents, and describe in your next weekly letter those three processes in full. You will thereby confer a great boon upon gas companies and gas consumers.

In conclusion we may state that comparative experiments, on the largest scale ever instituted, have been and are still going on between the New York and Manhattan Companies, for the purpose of fully testing the comparative merits of the oxide of iron and dry-lime methods, both companies using the same kinds of coal and collecting the same quantity of gas, the only difference being in purification. We think we can venture to predict that gas purified by dry-lime will be found to contain less sulphur, and will possess a higher illuminating power than gas purified by oxide of iron, and that the gas of the Manhattan Company is as pure as any illumiuating gas manufactured by large companies, either in this country or in Europe, as far as experiments are on record.

EDITORIAL ITEMS.

Northern Liberties Gas Co., Phil.—We notice by an advertisement in a Philadelphia paper, that owing to the increased wages of the employés in the above works, the Trustees have been necessitated to raise the price of gas, by adding 15 cents per 1000 cubic feet to that used by private consumers, and 7½ per cent. per 1000 cubic feet to that consumed by the public lamps. The price of gas therefore is now $2 55 per 1000 feet nett to private, and $1 27 per 1000 feet nett to public consumers, with 5 per cent. additional on bills not paid within five days after presentation. United States tax to be paid as hitherto by the consumers.

Fodell's System of Bookkeeping for Gas Companies.—In our issue of July 2nd we published a specimen of Part 1 of this work. In our present will be found a specimen of Part 2—Registrar's Department—which we trust will be an inducement for gas companies to subscribe for this very useful work, to ensure its publication at an early day.

☞ We have commenced in this issue the publication of an able lecture "On some of the Constituents of Coal Gas," by Dr. Odling, F.R.S., F.L.S., before the British Association of Gas Managers, which is worthy of our readers' perusal.

Correspondence.—Under this heading will be found another very interesting letter from J. S. Phillips, of California, Mining Engineer, in which he gives a beautiful description of the Humboldt mountains, its climate, its mineral prospects, etc., which will be interesting to our readers.

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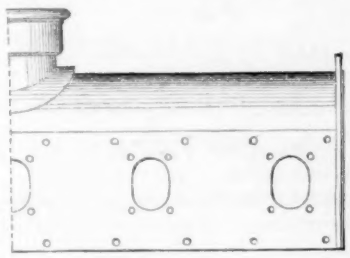

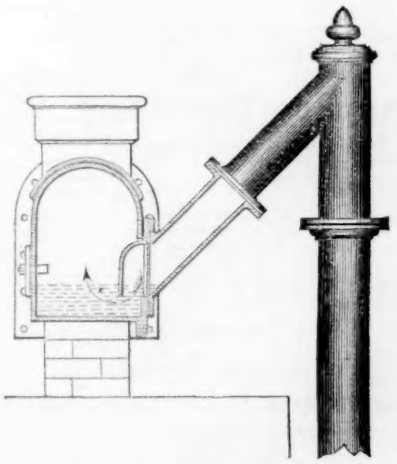

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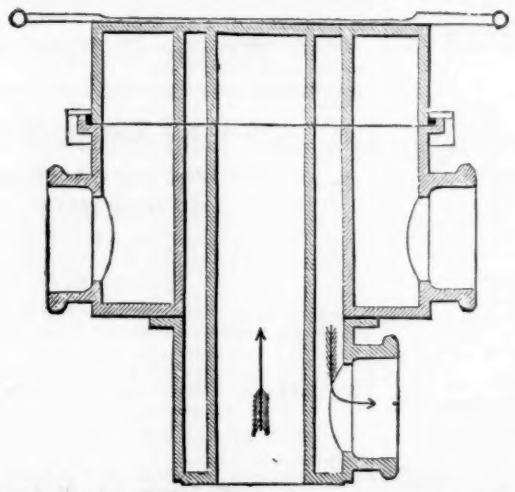

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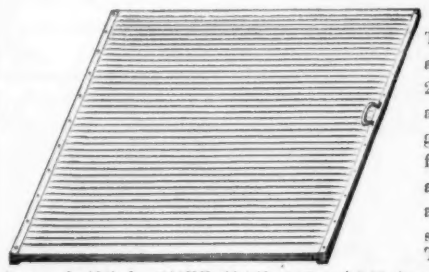

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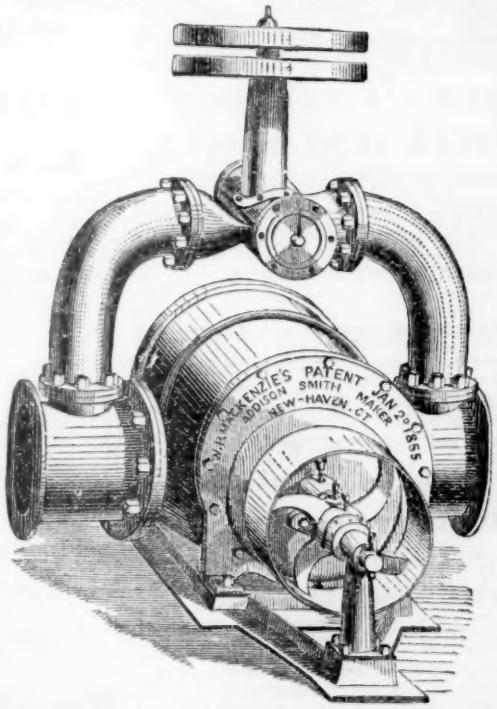

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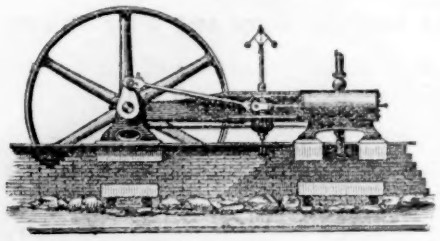

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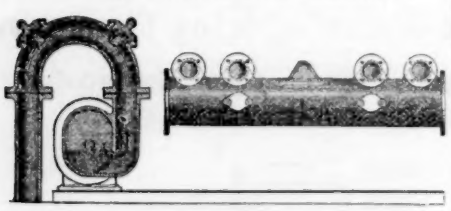

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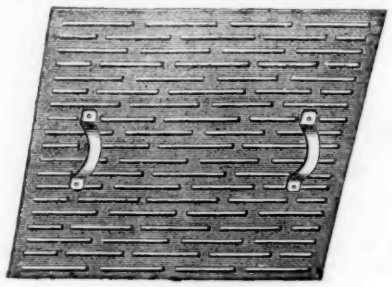

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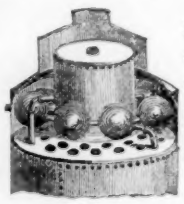

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Fig 5

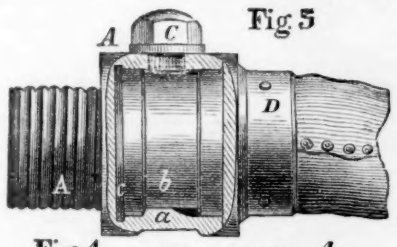


Fig 4

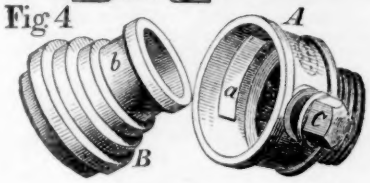
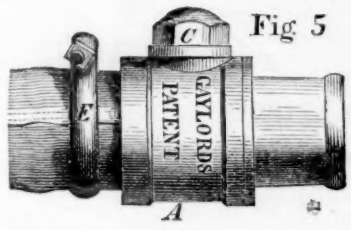


Fig 5



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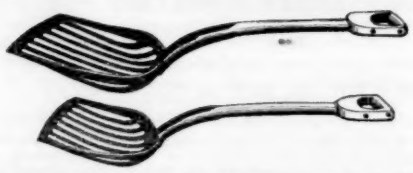

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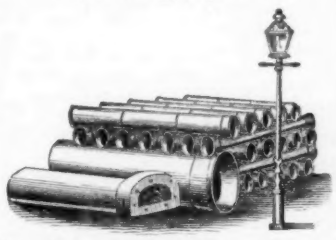

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France	10,710,000
Belgium	9,935,000
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British North America	1,500,000
Russia	1,500,000
Spain	300,000
New South Wales	250,000
Ireland	123,500
Total tons	176,858,500

It would appear, then, that of the total known produce of coal in the world, we raise considerably more than half (57 per cent), although we form probably not more than one in forty of the population of the world. If to our own coal produce we add that of the United States and our own colonies, we may conclude that the Teutonic race enjoys 73 per cent. or almost three parts out of four of the coal raised. It is hardly possible to overestimate the forces acting in our favor which are represented by this partial monopoly of the most powerful material agent of civilization.—*W. S. Jevons.*

OCT. 26, 1908.

Davy and the "Laughing Gas."

The dangers which enthusiastic men of science will voluntarily undergo for the sake of testing new principles have never been more strikingly exemplified than in the history of Sir Humphrey Davy's early experiments on the effect of nitrous oxide, popularly known as "laughing gas." Davy began his chemical studies in March, 1798, when a youth of eighteen, and only two years later appeared his Researches, which immediately gave him high rank, not as a mere chemist, but as an original discoverer. Herein, for the first time, the properties of nitrous oxide and the wonderful effects of that gas in respiration were disclosed to the astonishment of the public. Hitherto it had been regarded among natural philosophers with a sort of vague horror, and, from its deadly effects upon small animals, it was suspected that it was the very principle of the plague itself, that terrible visitation which, from time to time, swept over Europe. Nothing daunted by this, the young philosopher boldly resolved to try its effects on his own system. He could not have been ignorant of the terrors of Spallanzani's experiments upon the gastric juice, and only a short time before the courageous Pelletier, the French chemist, had lost his life in the attempt to breathe another kind of poisonous gas. But the boy philosopher thought it necessary to compare the effect of nitrous oxide with those of common stimulants, and he was resolved to pluck knowledge out of this dangerous trial. With this view, he shut himself up, and first submitted himself to to intoxication so extreme as to produce distressing and even alarming symptoms. To ascertain the effects of an atmosphere containing large quantities of the same gas, he enclosed himself in a box, and at three successive intervals, for an hour and a quarter (during which time he remained in the box) had sixty quarts of this gas thrown in, finally constituting a large proportion of the air which he was breathing. When the last twenty quarts were thrown in his emotions became similar to those produced by a moderate dose of the pure gas; but, not satisfied with this, immediately after coming out of his cage, he began to breathe in twenty quarts of nitrous oxide, probably the most effectual trial ever made of this wonderful agent.

"A thrilling," (he observes, in his own account of this audacious experiment) "extended from the chest to the extremities, was almost immediately produced. I felt a sense of tangible extension highly pleasureable in every limb; my visible impressions were dazzling and apparently magnified; I heard distinctly every sound in the room, and was perfectly aware of my situation. By degrees, as the pleasurable sensations increased, I lost all connection with external things; trains of vivid, visible images rapidly passed through my mind, and were connected with words in such a manner as to produce perceptions perfectly novel. I existed in a world of newly-connected and newly-modified ideas. I theorized; I imagined that I made discoveries. When I was awakened from this semi-delirious trance by Dr. Kinglake, who took nothing from my mouth, indignation and pride were the first feelings produced by the sight of the persons about me. My emotions were enthusiastic and sublime, and for a minute I walked around the room perfectly regardless of what was said to me. As I recovered my former state of mind I felt an inclination to communicate the discoveries I had made during the experiment. I endeavored to recall the ideas; they were feeble and indistinct. One collection of terms, however, presented itself, and with the most intense belief and prophetic manner I exclaimed to Dr. Kinglake, 'Nothing exists but thoughts—the universe is composed of impressions, ideas, and pains!'"

The impunity with which Davy had passed through these wonderful trials emboldened him to attempt the breathing of the deadly fumes from charcoal. His first attempt was made upon four quarts of carburetted hydrogen gas, of which he made three inspirations. "The first inspiration" (he tells us) "produced a sort of numbness and loss of feeling in the chest and about the pectoral muscles. After the second inspiration I lost all power of perceiving external things, and had no distinct sensation except a terrible oppression on the chest. During the third inspiration this feeling disappeared; I seemed sinking into annihilation, and had just power enough to drop the mouthpiece from my unclosed lips. A short interval must have passed during which I respired common air before the objects about me were distinguishable." On recollecting himself, he faintly articulated, "I do not think I shall die." Putting one finger upon his wrist, he found his pulse threadlike and beating with extreme quickness. Extreme giddiness, loss of memory, and numbness succeeded, with excruciating pains in the forehead and between the eyes, and transient pains in the chest and extremities.

Davy was, as far as his philosophical learning went, entire self-instructed. He was born at Penzance, in Cornwall, on the 17th of December, 1778. Though some attempt has been made to conceal the fact, there is no doubt that his father, Robert Davy, followed the humble occupation of a wood-carver. He was known in that town as "little carver Davy," and his son, when young, was always spoken of there as "Carver Davy's boy." His father dying when the lad was only sixteen, his mother commenced the business of milliner, and apprenticed her child to an apothecary at Penzance, where, for the first time, he began to show an interest in his favorite study.

"His means, of course," says his brother, Dr. Davy, "were very limited; not more extensive than those with which Priestly and Scheele began their labors in the same fruitful field. His apparatus consisted chiefly of phials, wine-glasses, teacups, tobacco-pipes, and earthen crucibles, and his materials were generally the mineral acids and the alkalies, and some other articles which are in common use in medicine." He began his experimental trials in his bedroom, in a friend's house, in which he was a favorite inmate. Here there was no fire, and when he required it he was obliged to come down to the kitchen with his crucible. His biographer, Dr. Paris, states that Davy was indebted to the accident of a wreck on the coast for a case of surgical instruments. This included a clumsy clyster apparatus, which he turned into an air-pump. The sacred vessels and professional instruments of the surgery were, without the least hesitation, put into requisition for any chemical experiments.

It can hardly be doubted that Sir Humphrey Davy's constitution, which was so vigorous in youth, withered and decayed long before he had reached old age from the effects of injuries sustained by these early experiments. He died in 1829, at Geneva, of an attack of apoplexy, but his end was singularly peaceful. When his brother, Dr. Davy, entered the room Sir Humphrey said "I am dying," or words to that effect. "When it is all over, I desire that no disturbance of any kind may be made in the house. Lock the door, and let every one retire to his apartment." The mortal remains of Carver Davy's son, the philosopher and discoverer, were honored with a public funeral, and deposited in the cemetery without the walls of Geneva.

IMITATION BRONZE.—The following is a method of giving cast-iron the appearance of bronze without coating it with any metal or alloy:—The article to be so treated is first cleaned with great care, and then coated with a uniform film of some vegetable oil; this done, it is exposed in a furnace to the action of a high temperature, which, however, must not be strong enough to carbonize the oil. In this way the cast-iron absorbs oxygen at the moment the oil is decomposed, and there is formed at the surface a thin coat of brown oxyd, which adheres very strongly to the metal, and will admit of a high polish, giving it quite the appearance of the finest bronze.

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Arnold's Metallic Gas Trays—T. G. Arnold, 334 and 336 West 21st street, N. Y. [6]
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Builder of Gas Works, Apparatus, Etc.—P. P. Delly, 39 Laurel street, Philadelphia [6]
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